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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/060,569	01/29/2002	Migaku Kobayashi	N230500C1	8651

7590

07/31/2002

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EXAMINER

GOUDREAU, GEORGE A

ART UNIT

PAPER NUMBER

1763

DATE MAILED: 07/31/2002

4

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No. 10-060,569	Applicant(s) Kobayashi
Examiner George Goudreau	Group Art Unit 1763

— The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address —

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- ☒ Responsive to communication(s) filed on (1-02' to 6-02') (ie, papers # 1-3)
- ☐ This action is FINAL.
- ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- ☒ Claim(s) 21-40 is/are pending in the application.
- Of the above claim(s) _____ is/are withdrawn from consideration.
- ☐ Claim(s) _____ is/are allowed.
- ☒ Claim(s) 21-40 is/are rejected.
- ☐ Claim(s) _____ is/are objected to.
- ☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

- ☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.
- ☐ The drawing(s) filed on _____ is/are objected to by the Examiner
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

- ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).
- ☐ All ☐ Some* ☐ None of the:
 - ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____

Attachment(s)

- ☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 3
- ☐ Interview Summary, PTO-413
- ☐ Notice of Reference(s) Cited, PTO-892
- ☐ Notice of Informal Patent Application, PTO-152
- ☐ Notice of Draftsperson's Patent Drawing Review, PTO-948
- ☐ Other _____

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15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. Claims 21-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Barth et. al. (1997').

Barth et. al. disclose a process for forming a via in a I.L.D. on a wafer which is comprised of the following steps:

-A via hole is formed in the I.L.D.;

-A Ti layer/ TiN is formed in via hole using any one of deposition methods selected from the group consisting of a collimated PVD (i.e.-physical vapor deposition), a long throw PVD, or a IMP (i.e.-ionized metal plating) deposition methods.;

-A W layer is conformably formed onto the surface of the TiN layer using a CVD deposition method.; and

-The W layer outside the via hole is etched back.

This is discussed specifically on pages 3-7, 10-11; and discussed on pages 1-12. Barth et. al. fail, however, to specifically disclose the following aspects of applicant's claimed invention:

-the specific formation of via holes in the ILD with the specific dimensions which are claimed by the applicant in the process taught above;

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- the anisotropic deposition of the Ti/TiN layers in the via hole in the I.L.D. in the process taught above;
- the specific etching of the W/TiN/Ti layers in those regions which cover the surface of the ILD which surrounds the via hole in the process taught above;
- the specific initial selective etch back of the W layer to the TiN layer in the process taught above such that the top surface of the W plug is recessed relative to the TiN layer on the surface of the ILD layer; and
- the specific removal of the TiN layer from the top surface of the ILD such that the W plug protrudes above the surface of the ILD on the wafer

It would have been inherent that any of the deposition methods which are used by the applicant for depositing the Ti/TiN layers in the process taught above, and are selected from the group consisting of collimated PVD, the long throw PVD, and the IMP would form these films in an anisotropic manner. The examiner cites the case law listed below of interest to the applicant in this regard.

In re Swinehart (169 U.S.P.Q. 226 (CCPA)) and In re Best (195 U.S.P.Q. 430 (CCPA)) state that when an examiner has reasonable basis for believing that functional characteristics asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be inherent characteristics of the prior art, the examiner possesses the authority to require an

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applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied upon.

It would have been obvious to one skilled in the art to remove all of the W/Ti/TiN material which is deposited outside of the via hole after the via hole has been filled based upon the following. It is conventional or at least well known in the via arts to remove all of the conductive material which has been deposited outside of the via hole during the via hole filling process prior to forming a wiring layer on the upper surface of the via in the I.L.D. (The examiner takes official notice in this regard.) Further, this etching process would desirably improve the mechanical stability of the interconnect formed between the upper wiring layer, and the via.

It would have been obvious to one skilled in the art to selectively etch the W layer which is deposited outside of the via hole to the TiN layer which is deposited outside of the via hole in the process taught above based upon the following. The selective removal of a conductive plug material which is deposited outside of the via hole in a I.L.D. on a wafer to the underlying barrier layer material which is deposited outside of the via hole after the conductive plug has been formed is conventional or at least well known in the semiconductor processing arts. (The examiner takes official notice in this regard.)

It would have been obvious to one skilled in the art to selectively remove the TiN layer from the surface of the ILD relative to the exposed regions of the W plug in the process taught above such that the W plug protrudes above the surface of the ILD on the wafer in the process

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taught above based upon the following. The conduction of such a process is conventional or at least well known in the semiconductor processing arts. (The examiner takes official notice in this regard.) Further, this would have simply involved the usage of an alternative, and at least equivalent means for forming the device in the process taught above to those means which are specifically taught above.

It would have been obvious to one skilled in the art to form via holes with the specific dimensions which are claimed by the applicant in the process taught above based upon the following. It would have been obvious to one skilled in the art to form via holes which are sufficiently large enough to support a via contact which is capable of transporting a target amount of current between adjacent layers of circuitry without forming an undesirably large contact hole with a corresponding undesirably large contact which would waste precious real estate on the chip as well as unnecessarily increase processing costs.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner George A. Goudreau whose telephone number is (703) -308-1915. The examiner can normally be reached on Monday through Friday from 9:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Examiner Gregory Mills, can be reached on (703) -308-1633. The appropriate fax phone number for the organization where this application or proceeding is assigned is (703) -306-3186.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) -308-0661.



George A. Goudreau/gag

Primary Examiner

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